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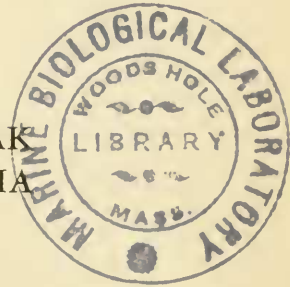
No. 5

THE GANDER OAK, A NEW HYBRID OAK  
FROM SAN DIEGO COUNTY, CALIFORNIA

BY

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IN THE NEARLY a century and a half since Neé published the first two species of *Quercus* from California (*Quercus agrifolia* and *lobata*) the list has grown so that now at least eighteen generally recognized species are believed to constitute the oak flora of the state. In addition to these species there are several rare forms which have evoked considerable interest. One of the first of these to be brought to the attention of botanists was the Oracle Oak ( $\times$  *Quercus morchus* Kellogg, Proc. Calif. Acad. Nat. Sci., 2:36, 1863), long suspected of being a hybrid between *Quercus Kelloggii* Newb. and *Quercus Wislizenii* A. DC., but only recently so demonstrated by cultural experiments at Rancho Santa Ana Botanic Garden (Rancho Santa Ana Bot. Gard., Occas. Papers, 1:47-52, 1938).

In 1935 Mr. Frank F. Gander, botanist of the Museum of Natural History at San Diego, California, discovered another peculiar oak somewhat similar to the Oracle Oak. This tree grew along the road between Santa Ysabel and Lake Henshaw. Shortly thereafter Mr. Gander informed us of his find and we visited the area, located the original tree and several others like it. In the fall of 1939 we obtained acorns of this new oak for propagation at Rancho Santa Ana Botanic Garden. The results of our studies in the field and in the Garden are embodied in the present paper. It is a pleasure to publish this oak as new in honor of Mr. Gander in the Proceedings of the California Academy of Sciences, since one of the parents of this hybrid is *Quercus Kelloggii*, a species honoring Dr. Albert Kellogg, one of the founders of the Academy, and also a most devoted student of our oaks. His beautiful draw-

ings of oaks were published in 1889 (Illustrations of West American Oaks, with the text by Dr. E. L. Greene). It has also seemed appropriate that this article should appear in the volume dedicated to Miss Alice Eastwood because she has long been interested in oaks and published one of the last of the generally recognized entities for California (*Quercus Alvordiana* Eastw., Handbook of the Trees of California, p. 48, pl. 27, fig. 4, 1905). She is a charter member of the Rancho Santa Ana Botanic Garden Advisory Board where her enthusiasm for the Garden's experimental work has been a constant stimulus for us to go forward with the numerous, painstaking, slow and often disappointing cultural projects, many of which seem to yield so little in proportion to the time and energy required for their completion.

× ***Quercus Ganderi*** C. B. Wolf, hybr. nov.

(*Quercus Kelloggii* Newb. × *Quercus agrifolia* var. *oxyadenia* [Torr.] J. T. Howell.)

Tree 10–16 m. high; 6–10 m. spread; trunk up to 1 m. in diam., the bark dark brown or gray, comparatively smooth and essentially like that of *Quercus Kelloggii*. In aspect the tree is erect, usually is taller than broad and more nearly resembles *Q. Kelloggii* than it does *Q. agrifolia* var. *oxyadenia*. Leaves nearly evergreen, turning yellow in January and shedding shortly before the new leaves appear. Branchlets densely puberulent, but in the second year becoming nearly glabrous. Petioles 1–2.5 cm. long; blades coriaceous, slightly cupped, glossy green above, but microscopically stellate-pubescent, especially along the midribs and veins, gray-green beneath and at first heavily stellate-pubescent, but in age becoming much less so, 5–10 cm. long, 3–6 cm. wide, shallowly and irregularly lobed with 3 or 4 main lobes on each side, these in turn irregularly margined and bearing 1–4 bristle-tipped teeth. Acorns solitary or 2–3 in a cluster, produced abundantly some years, and apparently maturing the first season; styles 3, about 2–3 mm. long; cup 12–18 mm. high, 15–25 mm. broad, the inner surface hairy at base, nearly glabrous at margins, scales thin, light tan with a darker border and mostly with ciliated margins, well imbricated in 6–8 rows; nut with lower one-third covered by the cup, oblong, 25–35 mm. long, lightly pubescent to nearly glabrous without, densely pubescent within, rich light brown at maturity. (The acorns are scarcely distinguishable from those of *Q. Kelloggii*, except that the nut is somewhat slenderer pointed.) Staminate aments slender, pubescent, borne in clusters of several; each ament 4–6 cm. long, bearing about 15–20 flowers, each with 6–8 stamens.

Arbor erecta, circiter 10–16 m. altitudine; ramulis junioribus tomentellis; foliis habitus *Quercus Kelloggii*, 5–10 cm. longis, 3–6 cm. latis; pagina superiore sub-glabra, inferiore stellata-tomentosa; cupulis 12–18 mm. altitudine, squamis planis; glandibus oblongis, 25–35 mm. longis.

Habitat. Lower borders of the Arid Transition and the upper borders of the Upper Sonoran Life Zones at elevations of 3000 to 3200 feet, in association

with *Quercus Kelloggii*, *agrifolia* var. *oxyadenia* and *Engelmannii*, growing on hillsides and near occasional streams in granitic type soils.

Range. Known only from the mountains of San Diego County, California. All of the known trees are located in a rather restricted area extending from the Volcan Indian School, located north of Santa Ysabel, to a mile or two west of Lake Henshaw Dam and to the vicinity of Mesa Grande.

Type-Locality. San Diego County, California, about 300 yards north of the entrance to the Volcan Indian School on California State Highway No. 79 between Santa Ysabel and Lake Henshaw, at 3100 feet elevation, in decomposed granite soil, near an occasional stream just west of the highway. Type Specimen: *Carl B. Wolf and Percy C. Everett, Herb. No. 9543 (Prop. No. 3555)*, collected October 20, 1939, the tree being 16 m. high, 10 m. spread, its trunk branching into three main forks near the ground, two of these being about 46 cm. in diam., and the third about 20 cm. in diam. The Type Specimen is deposited in Rancho Santa Ana Botanic Garden Herbarium, sheet no. 23585. Isotypes widely distributed as indicated below.

Localities and Specimens Examined. All of the localities mentioned below are in San Diego County, California.

1). Near the entrance to the Volcan Indian School between Santa Ysabel and Lake Henshaw, at 3100 feet elevation: *Frank F. Gander*, Nov. 14, 1935, and May 6, 1937; *C. B. Wolf and P. C. Everett, Herb. No. 9483*, January 10, 1939; *P. C. Everett, Herb. No. 9529*, July 28, 1939; *C. B. Wolf and P. C. Everett, Herb. No. 9543 (Prop. No. 3555)*, Oct. 20, 1939, Type Collection. (All of the above specimens were made from the same tree.)

2). Between Santa Ysabel and Lake Henshaw, on the Morelli Ranch, located about 2 miles south of the junction of the road to Warner's Hot Springs and Henshaw Dam, 3000 feet elevation: *C. B. Wolf, Herb. No. 9487*, January 24, 1939, from a tree 10 m. high, 10 m. spread, and a trunk 60 cm. in diam.; and from the same tree, *C. B. Wolf and P. C. Everett, Herb. No. 9542 (Prop. No. 3554)*, October 20, 1939.

3). Mesa Grande, *M. V. Hood*, Nov. 24, 1940.

4). One and eight-tenths miles from Mesa Grande on the road to Lake Henshaw, at 3200 feet elevation: *C. B. Wolf, Herb. No. 9488*, January 24, 1939, from a tree 11–12 m. high, 6–7 m. spread, and a trunk 35 cm. in diam.; *C. B. Wolf, Herb. No. 9489*, January 24, 1939, from a tree 12–13 m. high, 11–12 m. spread, and a trunk nearly 1 m. in diam.

5). Between Mesa Grande and Lake Henshaw (north of the above locality). Several trees were noted on January 24, 1939, on the slopes away from the road, but for lack of time no collections were made.

6). On the hills to the south and west of Lake Henshaw Dam. The trees noted in this area on January 24, 1939, appeared to be the northwest limit of distribution for the Gander Oak in this region, but for lack of time no specimens were collected.

In its native habitat the individual trees of the Gander Oak are difficult to

detect during most of the year except upon close examination, for they are mixed with the Kellogg Oak, which they closely resemble. However, in the late fall or early winter they can readily be spotted on the hillsides. At those times the leaves of the Kellogg Oak have been shed, while those of the Gander Oak are beginning to turn yellow. In January of 1939 we were able to locate between 20 and 30 Gander Oaks in the vicinity of Lake Henshaw and Mesa Grande merely by driving slowly along the roads that traverse the areas. Exploration of the adjacent hillsides not visible from these roads would likely result in increasing this figure considerably. It is also probable that the Gander Oak occurs elsewhere in San Diego County, but thus far no additional localities have been brought to our attention. All of the trees of the Gander Oak which we have seen in the wild appear to be first-generation crosses between the two parents, despite the fact that fertile acorns appear to be produced somewhat regularly. However, this lack of second-generation offspring in the wild is in keeping with the behavior of many other wild hybrids.

Wild trees of  $\times$  *Quercus Ganderi* can be distinguished from *Quercus Kelloggii* by the less deeply lobed and slightly cupped leaves with considerable pubescence beneath, and by the longer persistence of the foliage. Separation of  $\times$  *Quercus Ganderi* from  $\times$  *Quercus morchus* is also relatively easy, although the leaves of the two are very similar in size and outline. The latter species has nearly plane leaves whose under surfaces are practically glabrous. Furthermore,  $\times$  *Quercus morchus* requires two seasons to mature its acorns, whereas,  $\times$  *Quercus Ganderi* appears to mature its acorns in a single season (as does *Quercus agrifolia* var. *oxyadenia*).

In October, 1941, Mr. John M. Tucker of the Department of Botany of the University of California, Berkeley, California, forwarded us an oak specimen (*Tucker No. 418*) collected on the University of California Hastings Wild Life Reserve in the Santa Lucia Mountains of Monterey County. This specimen appears to be a hybrid between *Quercus Kelloggii* and *Quercus agrifolia*, but we have not been able to visit the area and see the tree growing in the wild, nor has it been possible to obtain acorns for propagation. Tucker's specimen closely resembles  $\times$  *Quercus Ganderi*, but is essentially glabrous. The status of this oak should be determined by additional field studies and by experimental methods. If it should be demonstrated that it is a hybrid, as suggested above, it could hardly be included in the present concept of  $\times$  *Quercus Ganderi* unless that concept be enlarged and *Quercus agrifolia* var. *oxyadenia* be reduced to synonymy under *Quercus agrifolia*.

#### CULTURAL STUDIES

Because of the practical difficulties involved in making experimental crosses in the field we have not attempted to produce  $\times$  *Quercus Ganderi* by hybridizing *Quercus Kelloggii* and *Quercus agrifolia* var. *oxyadenia*. We have, however, been able to observe the behavior of seedlings of  $\times$  *Quercus Ganderi* and feel that they have yielded sufficient data to justify our conclusion that



the tree is a hybrid between *Quercus Kelloggii* and *Quercus agrifolia* var. *oxyadenia*.

In October, 1939, Mr. Everett and I hand-picked over 400 acorns from the Type Tree of  $\times$  *Quercus Ganderi* (*Herb. No. 9543, Prop. No. 3555*), and 11 acorns from a second tree in the same region (*Herb. No. 9542, Prop. No. 3554*). These acorns were subsequently planted in our lathhouse, where by April, 1940, there were 311 seedlings of the former and 8 of the latter. In contrast to the seedlings of  $\times$  *Quercus morchus*, grown previously, these were remarkably vigorous and attained average heights of over 30 cm. the first season.

Plantings of 189 seedlings (random selections) of the Gander Oak (*Prop. No. 3555*) were made in the Garden on March 10, 1941. Only 61 of these survived to October, 1942. This unusually high loss can be accounted for in part because at that time the Botanic Garden Nursery was moved and it was necessary to dig the seedlings and hold them for considerable time before planting. The remainder of the seedlings of this same lot were lined out in nursery rows where over 50 are still alive. In the same nursery rows are 5 seedlings of *Prop. No. 3554*. These seedlings in the Garden and in the nursery rows now show the usual intergradation of characters displayed when seeds of a hybrid are propagated. Those seedlings closely resembling *Quercus Kelloggii* are now few in number, for, under our conditions, that species has always been difficult to grow. The rest of the seedlings now alive represent several typical *Quercus agrifolia* var. *oxyadenia*, a large number of forms very much like the original  $\times$  *Quercus Ganderi*, and many of varying characteristics. Some have the leaf shapes nearly like *Quercus Kelloggii*, but are exceptionally pubescent. Others are like *Quercus agrifolia* var. *oxyadenia*, but are glabrous. Still others have numerous intermediate leaf characters and are even more unlike either of the parent species of the original cross. It will be many years before acorns are produced by these seedlings, but they will likely show an almost continuous series of variations between the slender form produced by the one parent and the thick form by the other. It is also probable that some of these seedlings will require two seasons to mature acorns while others should do so in a single season.

$\times$  *Quercus Ganderi* may eventually prove of some merit for horticulture, for it has many of the fine features of *Quercus Kelloggii*, plus semi-evergreen foliage, a vigorous growth rate and hardiness at low elevations. Acorns gathered from some of the wild trees could be grown in the nursery for two or three years, so that selections of outstanding horticultural types could be made before making permanent plantings.

The accompanying drawings on Plates 18 and 19 of *Quercus Kelloggii*, *agrifolia* var. *oxyadenia*, *Ganderi* and the nursery seedlings grown from the latter were prepared from tracings (except the drawings of the acorns). It is hoped that they will convey to the reader not only the characteristics of the parental species and the original hybrid, but also the great variation exhibited by the seedlings.

## DISTRIBUTION OF HERBARIUM SPECIMENS

Specimens referred to in the text and in the figures are all on deposit in Rancho Santa Ana Botanic Garden Herbarium with the exception of the two specimens by F. F. Gander and the one by M. V. Hood, which are in the San Diego Museum of Natural History Herbarium. Duplicates of our collections of  $\times$  *Quercus Ganderi* have been distributed as follows:

California Academy of Sciences, San Francisco, California: Nos. 9483, 9487, 9488, 9489, 9529, 9543;

Dudley Herbarium, Stanford University, California: Nos. 9483, 9487, 9488, 9489, 9529, 9542, 9543;

Field Museum of Natural History, Chicago, Illinois: No. 9543;

Los Angeles Museum, Los Angeles, California: No. 9543;

Missouri Botanical Garden, St. Louis, Missouri: No. 9543;

New York Botanical Garden, New York City, N. Y.: No. 9543;

Philadelphia Academy of Natural Sciences, Philadelphia, Penna.: No. 9543;

Pomona College, Claremont, California: No. 9543;

San Diego Museum of Natural History, San Diego, California: Nos. 9483, 9487, 9488, 9489, 9529, 9543;

United States National Herbarium, Washington, D. C.: Nos. 9483, 9488, 9543;

University of Arizona, Tucson, Arizona: No. 9543;

University of California, Berkeley, California: Nos. 9483, 9487, 9488, 9489, 9529, 9543;

University of California, Los Angeles, California: Nos. 9483, 9543;

University of Colorado, Boulder, Colorado: No. 9543;

University of Montana, Missoula, Montana: No. 9543;

University of Washington, Seattle, Washington: No. 9543.

## EXPLANATION OF PLATES

PLATE 18

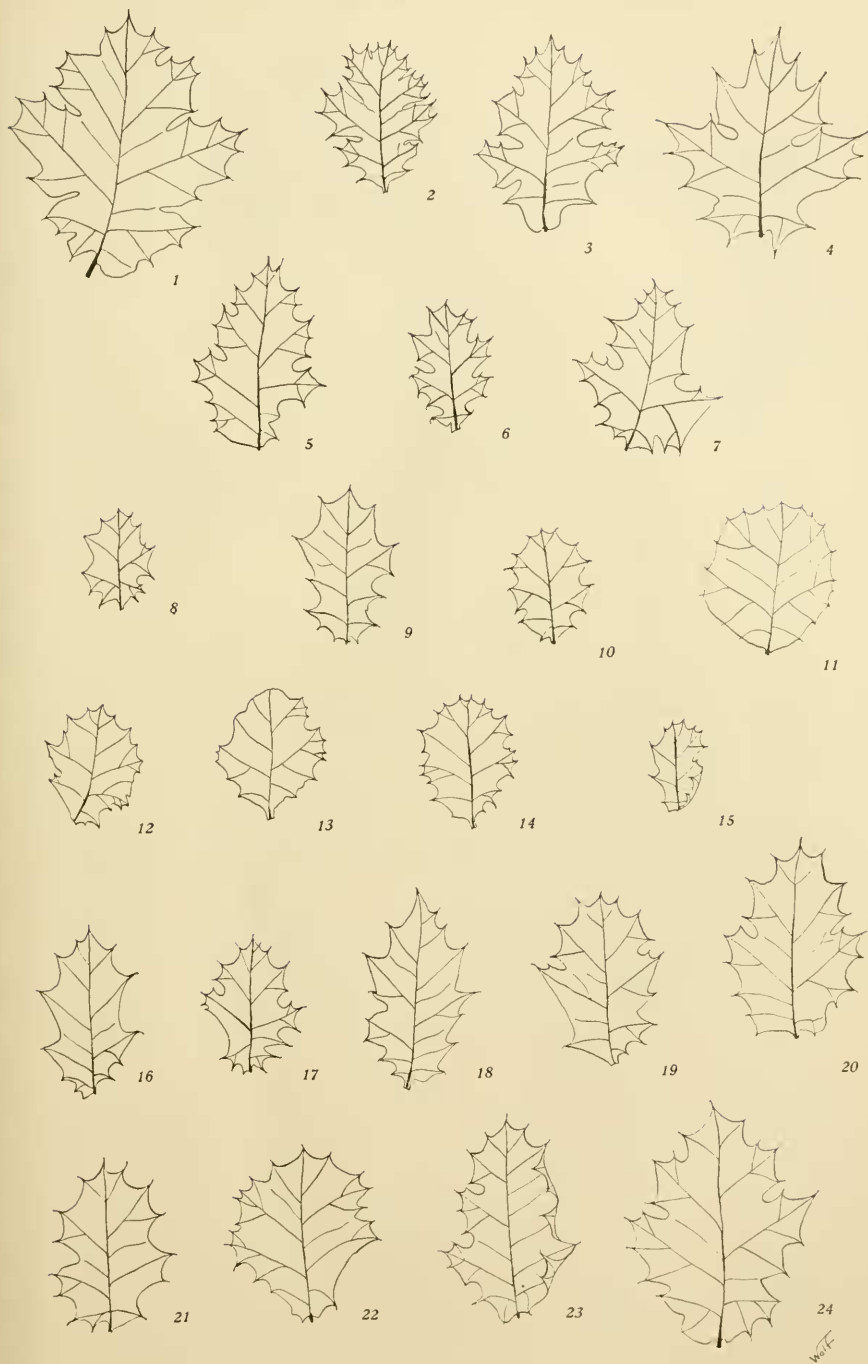
Figs. 1-24. Leaves of seedlings of  $\times$  *Quercus Ganderi* C. B. Wolf; collected from Botanic Garden plantings and nursery rows, January 13, 1943, *Prop. No. 3555* (grown from acorns taken from Type Tree).

Figs. 1-7. From seedlings most nearly like *Quercus Kelloggii*.

Figs. 8-15. From seedlings most nearly like *Quercus agrifolia* var. *oxyadenia*.

Figs. 16-24. From seedlings most nearly like  $\times$  *Quercus Ganderi* and intermediate forms.





5 cm.

PLATE 19

- Figs. 1-10. *Quercus Kelloggii* Newb.  
 Figs. 11-18. *Quercus agrifolia* var. *oxyadenia* (Torr.) J. T. Howell.  
 Figs. 19-30.  $\times$  *Quercus Ganderi* C. B. Wolf.
- Fig. 1. *C. B. Wolf, Herb. No. 2488* (wild).  
 Fig. 2. *J. T. Howell, Herb. No. 683* (wild).  
 Figs. 3 and 4. *C. B. Wolf, Herb. No. 3992* (wild).  
 Fig. 5. *C. B. Wolf and B. D. Stark, Herb. No. 5482* (wild).  
 Fig. 6. *P. C. Everett, Herb. No. 6084* (nursery seedlings of *Prop. No. 1951*).  
 Fig. 7. *C. B. Wolf, Herb. No. 5572* (nursery seedlings of *Prop. No. 1951*).  
 Fig. 8. *P. C. Everett, Herb. No. 6078* (nursery seedlings of *Prop. No. 1952*).  
 Fig. 9. *B. D. Stark, Herb. No. 798* (acorn, wild).  
 Fig. 10. *C. B. Wolf, Herb. No. 2488* (acorn, wild).  
 Fig. 11. *J. T. Howell, Herb. No. 600* (wild).  
 Fig. 12. *B. D. Stark, Herb. No. 5552* (wild).  
 Fig. 13. *I. L. Wiggins and J. W. Gillespie, No. 4053* (wild).  
 Fig. 14. *B. D. Stark, Herb. No. 5552* (wild).  
 Fig. 15. *I. L. Wiggins and J. W. Gillespie, No. 4053* (acorn, wild).  
 Fig. 16. *B. D. Stark, Herb. No. 5552* (acorn, wild).  
 Figs. 17 and 18. *P. C. Everett, Herb. No. 6074* (nursery seedlings of *Prop. No. 2026*).  
 Fig. 19. *C. B. Wolf, Herb. No. 9489* (wild, as are also nos. 20-30).  
 Fig. 20. *C. B. Wolf and P. C. Everett, Herb. No. 9483*.  
 Fig. 21. *C. B. Wolf and P. C. Everett, Herb. No. 9543* (Type).  
 Figs. 22 and 23. *C. B. Wolf and P. C. Everett, Herb. No. 9543* (acorns from the Type).  
 Fig. 24. *P. C. Everett, Herb. No. 9529* (young acorn).  
 Fig. 25. *C. B. Wolf, Herb. No. 9488*.  
 Fig. 26. *C. B. Wolf, Herb. No. 9489*.  
 Fig. 27. *C. B. Wolf and P. C. Everett, Herb. No. 9542*.  
 Fig. 28. *C. B. Wolf and P. C. Everett, Herb. No. 9543* (Type).  
 Fig. 29. *C. B. Wolf and P. C. Everett, Herb. No. 9487*.  
 Fig. 30. *C. B. Wolf and P. C. Everett, Herb. No. 9542*.



